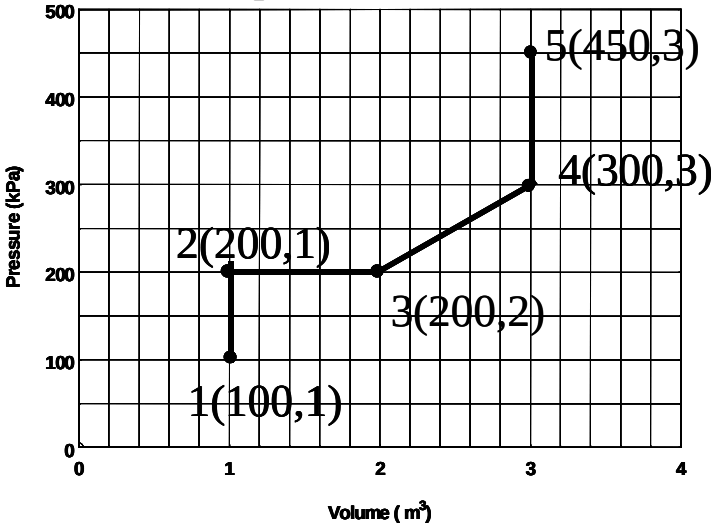
Question 1: [10 points]



Question 2: [10 points]

State 1: determine the pressure $P=RT/(v-b)-a/v^2$= 0.3 kPa·m^3/kg-K *280K/(0.6-0.05)m^3/kg -0.5 m^6 kPa/kg^2/ $(0.6)^2$ $(m^3/kg)^2$ =152.7kPa- 1.39kPa=151.3 kPa

State 2: $P_2/P_1=(v_2/v_1)^{-n}$=5.2→ P_2=786.8 kPa.

Next we use $\left(P+\frac{a}{v^2}\right)(v-b)=RT$ to find T_2

$T_2=(P_2+a/v_2^2)(v_2-b)/R=(786.8+0.5/(0.2)^2)(0.2-0.05)$ / 0.3= 399.65 K

Question 3: [5 points]

U_1+ke= U_2(T)

Solution:

a) 1st law: ½ mv^2 = mCΔT→ ΔT=½ v^2/C

= ½ (500 m/s)^2/ 1000 /0.4=312.5 ^oC

final temperature = 80^oC+ 312.5^oC =392.5 ^oC

Question 4: [15 points]:

u2= u1; At 100 C , u2=u1=419.06 kJ/kg

V2=1000 V1→ v_2= 1000*v1= 1000* 0.001043 m^3/kg =1.043 m3/kg

Next

u2= uf+ x ufg

v2= vf+ x vfg

Yes, u and v are independent properties. By trial and error, we can estimate the pressure, temperature, and quality, *x*, at the equilibrium state. Trial and error procedure: Guess a saturated temperature, determine quality *x* based on *u*. Then determine *x* based on *v*. If the difference between these two *x* values are less than, say, 0.1 one can stop.

Trial error to determine if x agrees

1) T=90, x= (u2-uf)/ufg =0.019, x=(v2-vf)/vfg=0.44
2) T=50 x=0.09 x=0.083 close ~ 50C